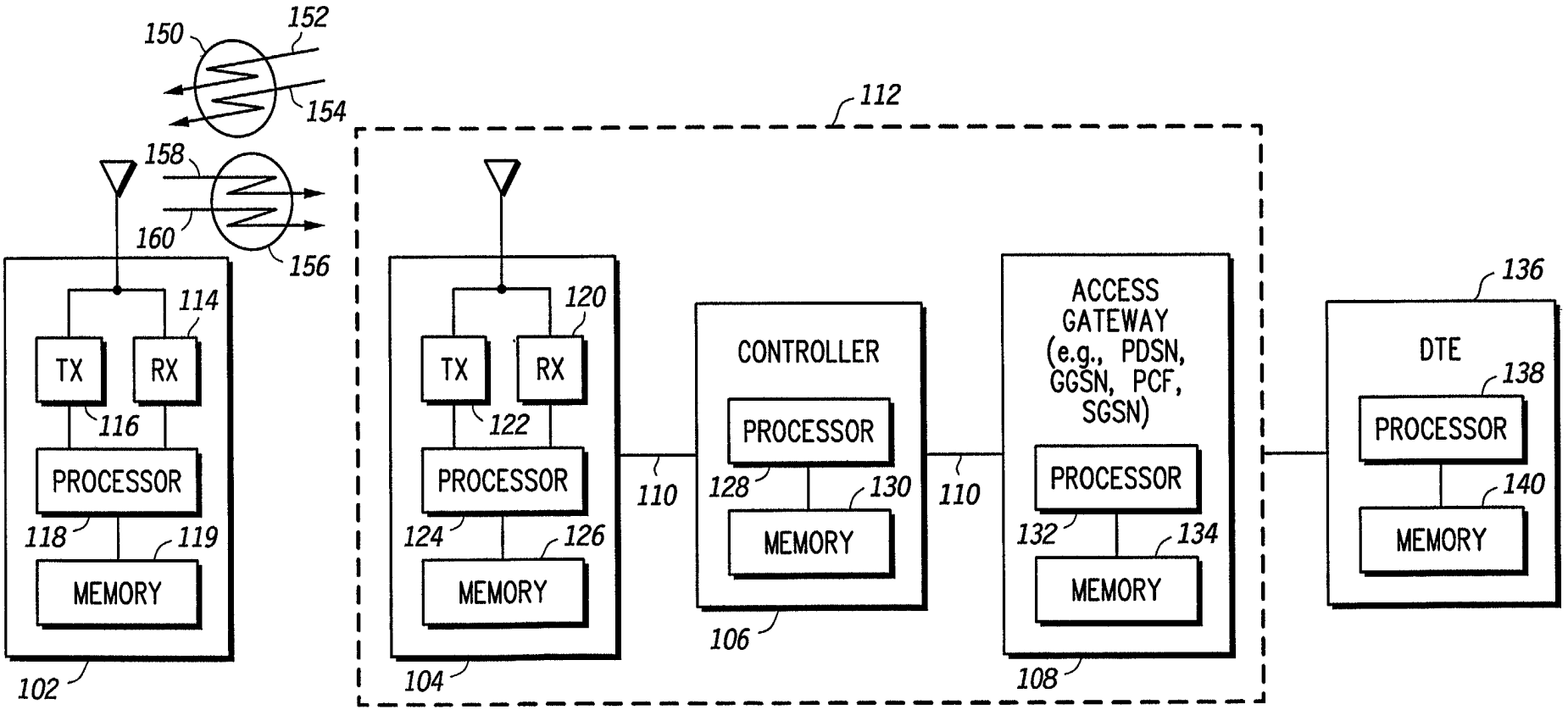

150
152
154
158
160
156
112
114
TX
RX
116
PROCESSOR
118
119
MEMORY
102
120
TX
RX
122
PROCESSOR
124
126
MEMORY
104
110
CONTROLLER
PROCESSOR
128
130
MEMORY
106
110
ACCESS GATEWAY (e.g., PDSN, GGSN, PCF, SGSN)
PROCESSOR
132
134
MEMORY
108
136
DTE
PROCESSOR
138
140
MEMORY
100

FIG.1

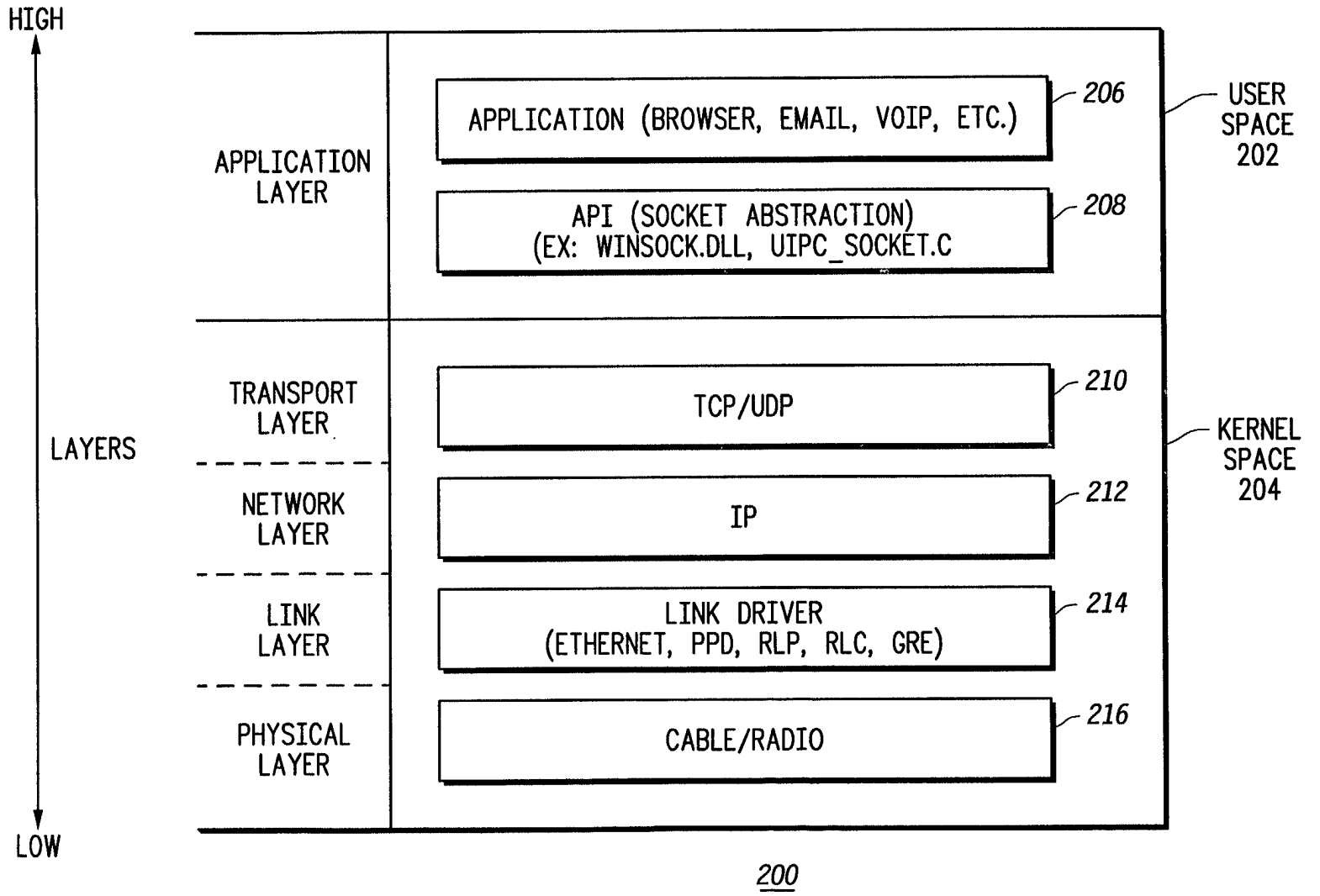
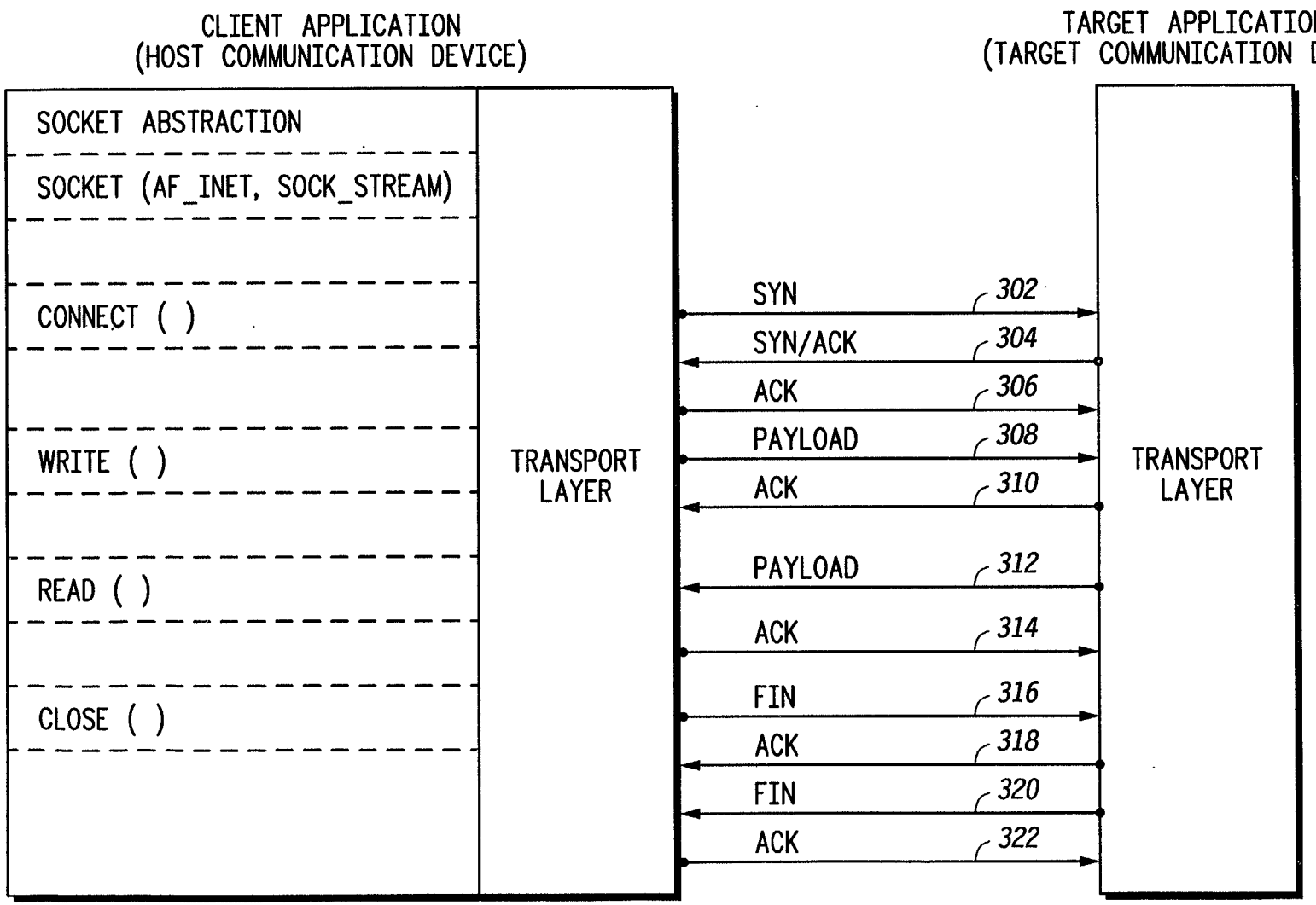


FIG.2
-PRIOR ART-



300

FIG.3
-PRIOR ART-

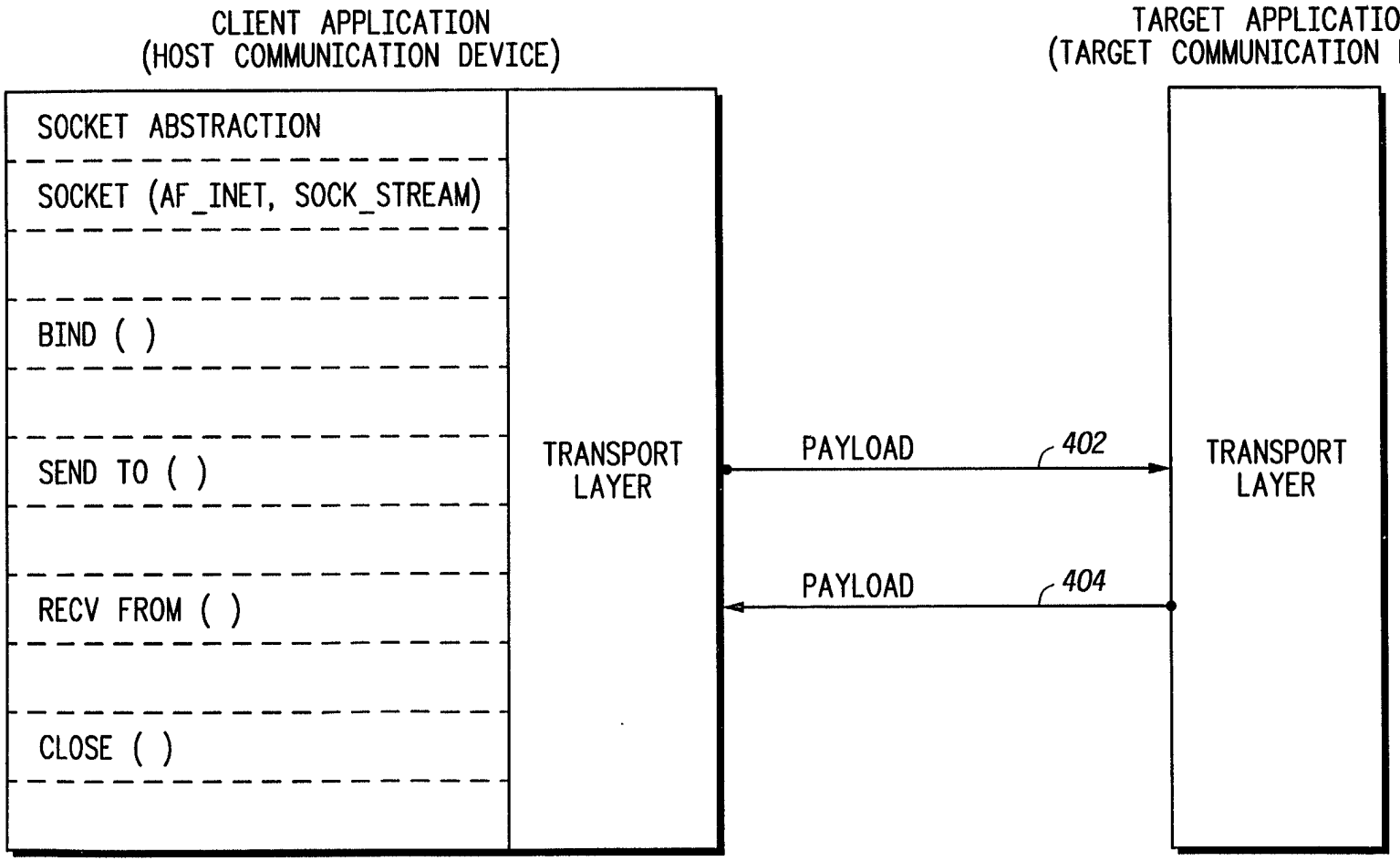


FIG.4
-PRIOR ART-

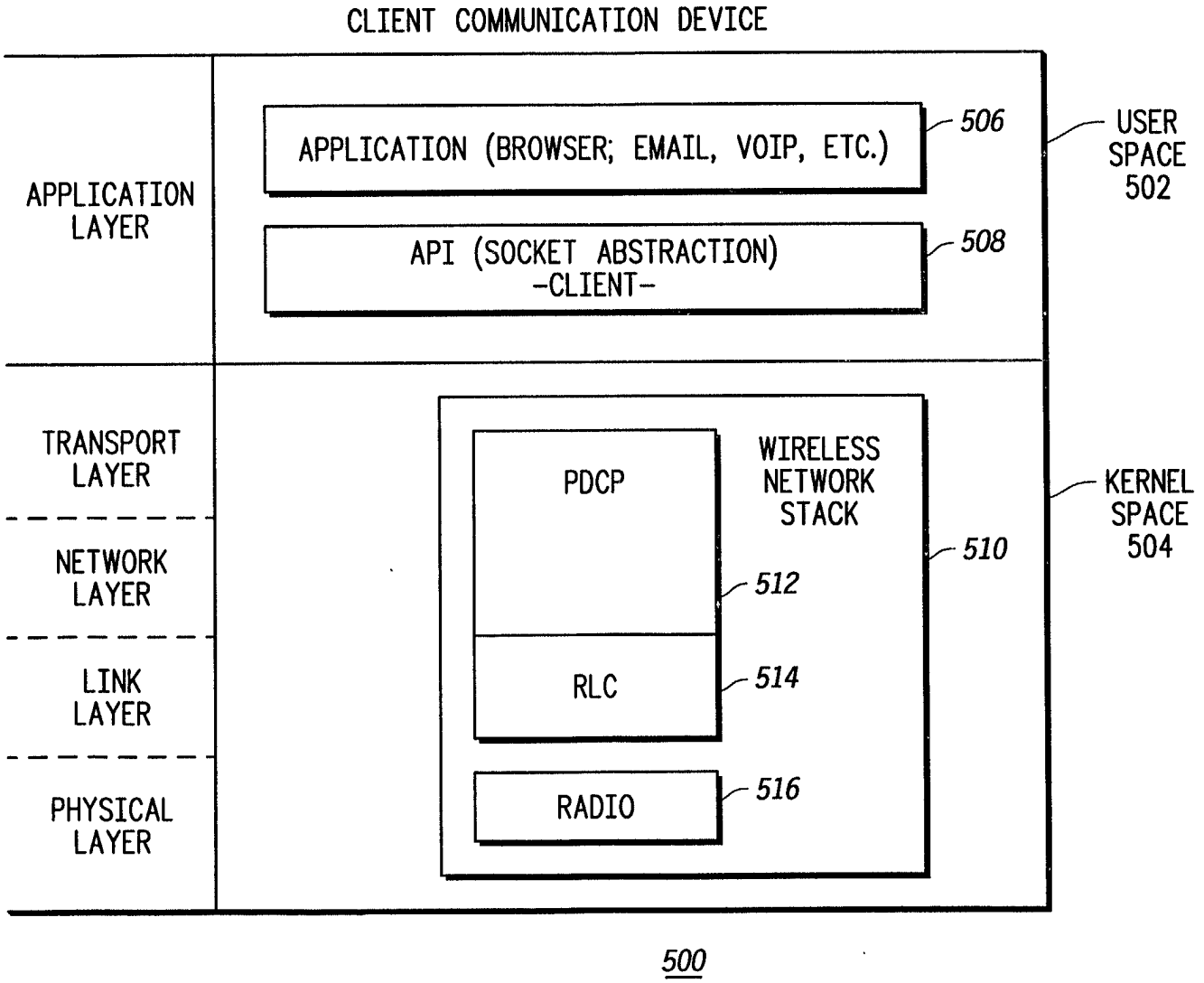

CLIENT COMMUNICATION DEVICE
APPLICATION LAYER
TRANSPORT LAYER
NETWORK LAYER
LINK LAYER
PHYSICAL LAYER
APPLICATION (BROWSER; EMAIL, VOIP, ETC.)
506
API (SOCKET ABSTRACTION) -CLIENT-
508
USER SPACE 502
PDCP
512
RLC
514
RADIO
516
WIRELESS NETWORK STACK
510
KERNEL SPACE 504
500

FIG.5

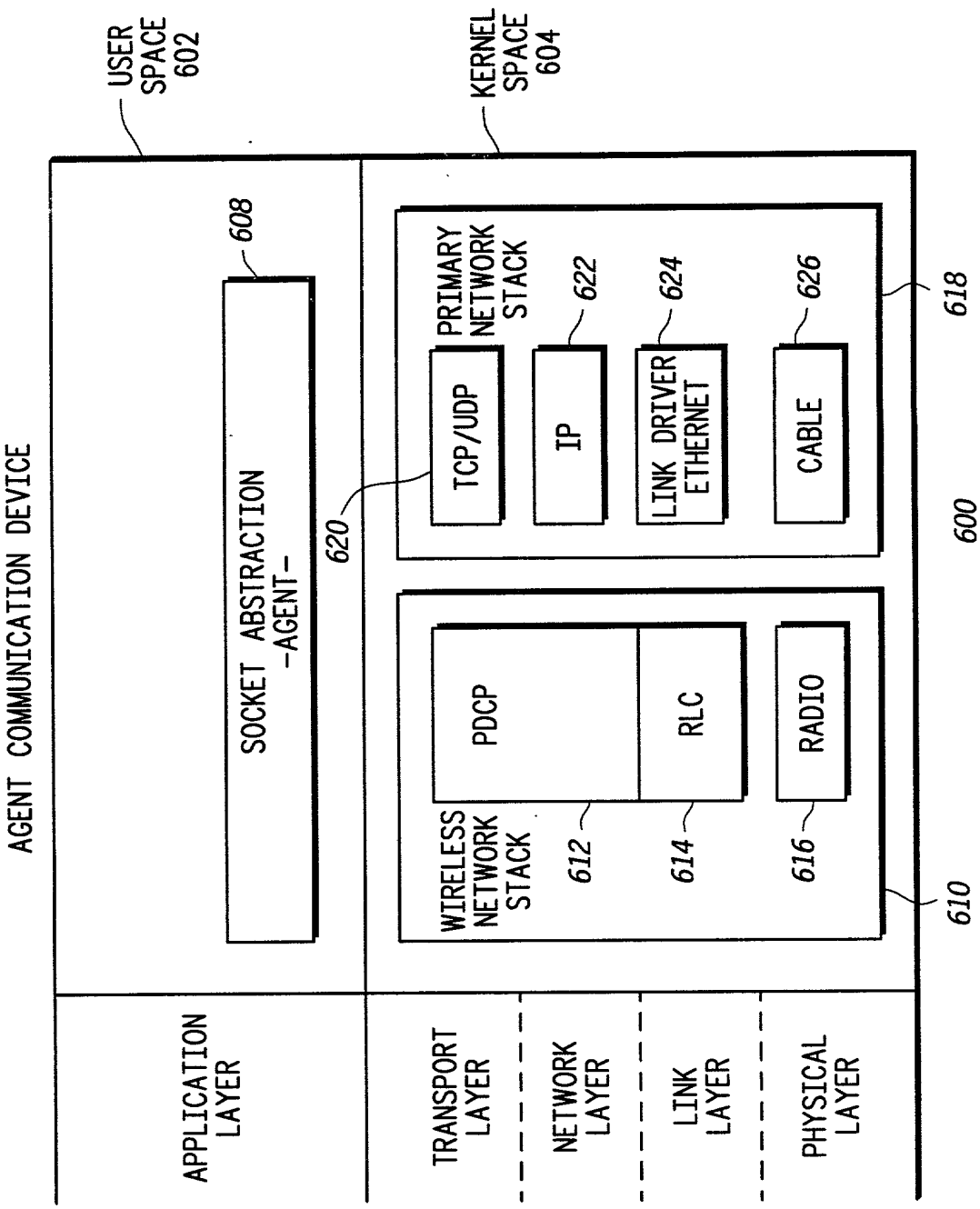

AGENT COMMUNICATION DEVICE
USER SPACE 602
KERNEL SPACE 604
APPLICATION LAYER
TRANSPORT LAYER
NETWORK LAYER
LINK LAYER
PHYSICAL LAYER
SOCKET ABSTRACTION -AGENT-
608
620
PRIMARY NETWORK STACK
TCP/UDP
IP
LINK DRIVER ETHERNET
CABLE
622
624
626
618
WIRELESS NETWORK STACK
PDCP
RLC
RADIO
612
614
616
610
600

FIG. 6

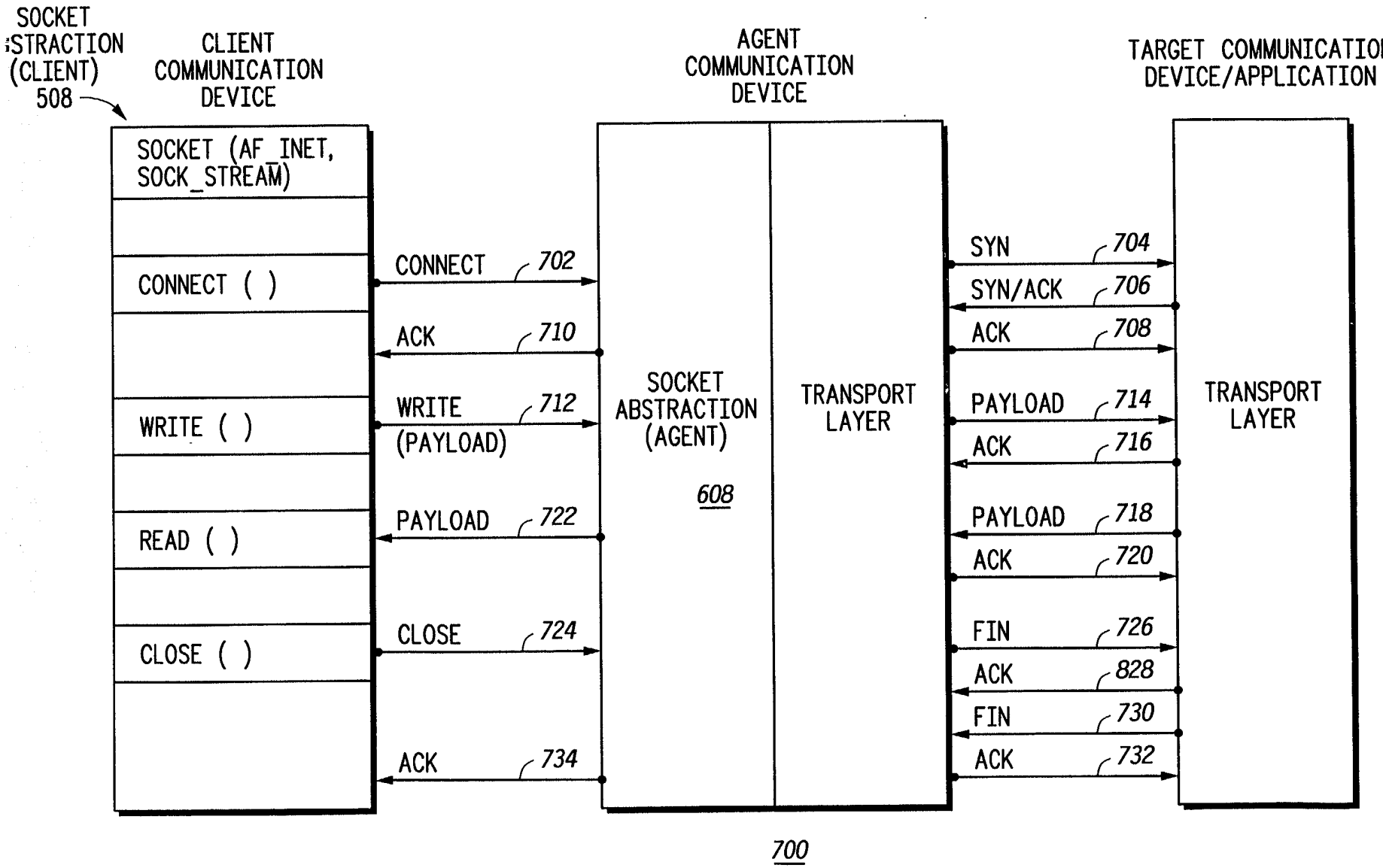

SOCKET ABSTRACTION (CLIENT) 508
CLIENT COMMUNICATION DEVICE
AGENT COMMUNICATION DEVICE
TARGET COMMUNICATION DEVICE/APPLICATION
SOCKET (AF_INET, SOCK_STREAM)
CONNECT ( )
WRITE ( )
READ ( )
CLOSE ( )
CONNECT 702
ACK 710
WRITE (PAYLOAD) 712
PAYLOAD 722
CLOSE 724
ACK 734
SOCKET ABSTRACTION (AGENT) 608
TRANSPORT LAYER
SYN 704
SYN/ACK 706
ACK 708
PAYLOAD 714
ACK 716
PAYLOAD 718
ACK 720
FIN 726
ACK 828
FIN 730
ACK 732
TRANSPORT LAYER
700

FIG. 7

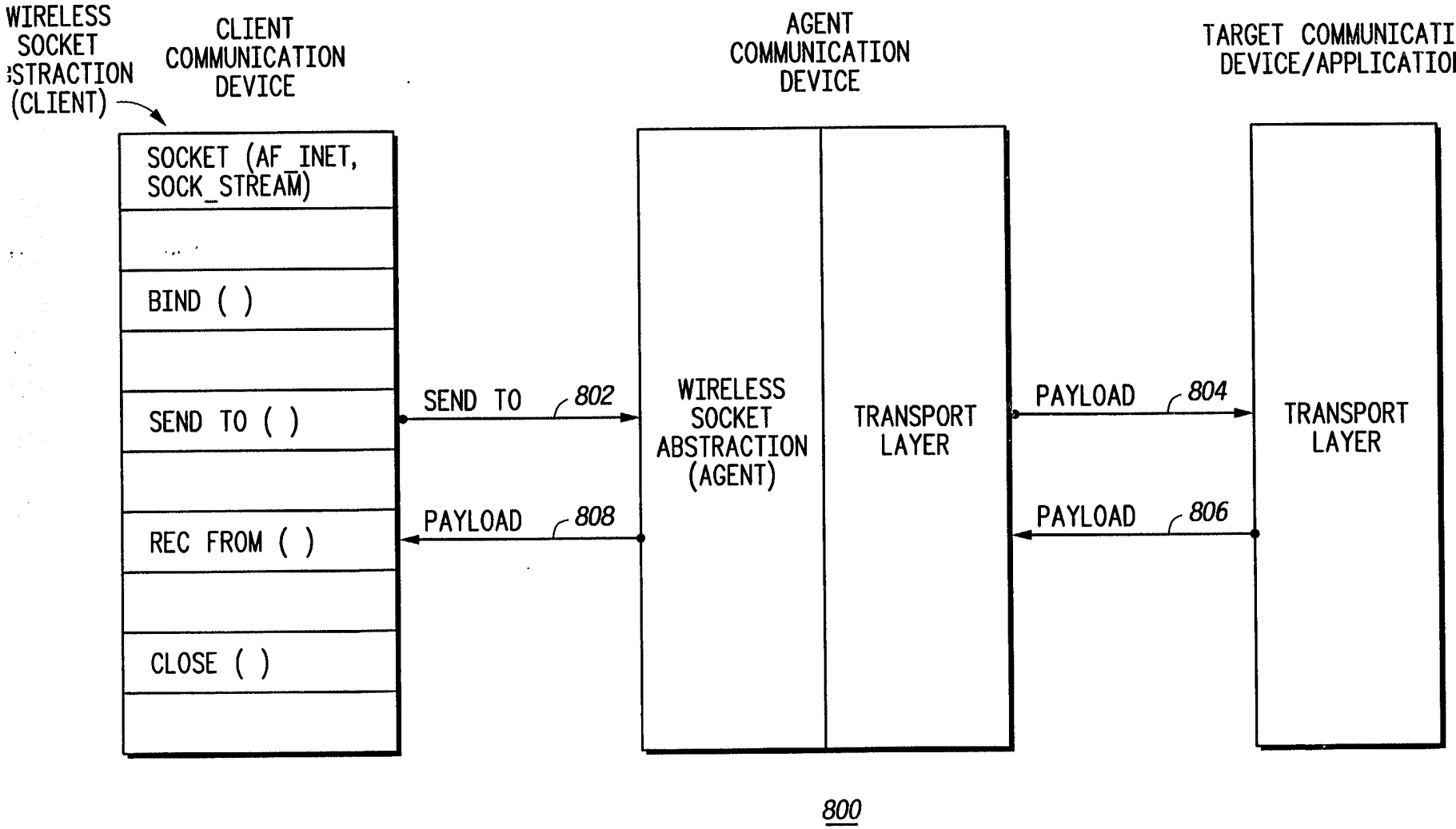

WIRELESS SOCKET STRACTION (CLIENT)
CLIENT COMMUNICATION DEVICE
AGENT COMMUNICATION DEVICE
TARGET COMMUNICATION DEVICE/APPLICATION
SOCKET (AF_INET, SOCK_STREAM)
BIND ( )
SEND TO ( )
REC FROM ( )
CLOSE ( )
SEND TO
802
PAYLOAD
808
WIRELESS SOCKET ABSTRACTION (AGENT)
TRANSPORT LAYER
PAYLOAD
804
PAYLOAD
806
TRANSPORT LAYER
800

FIG.8

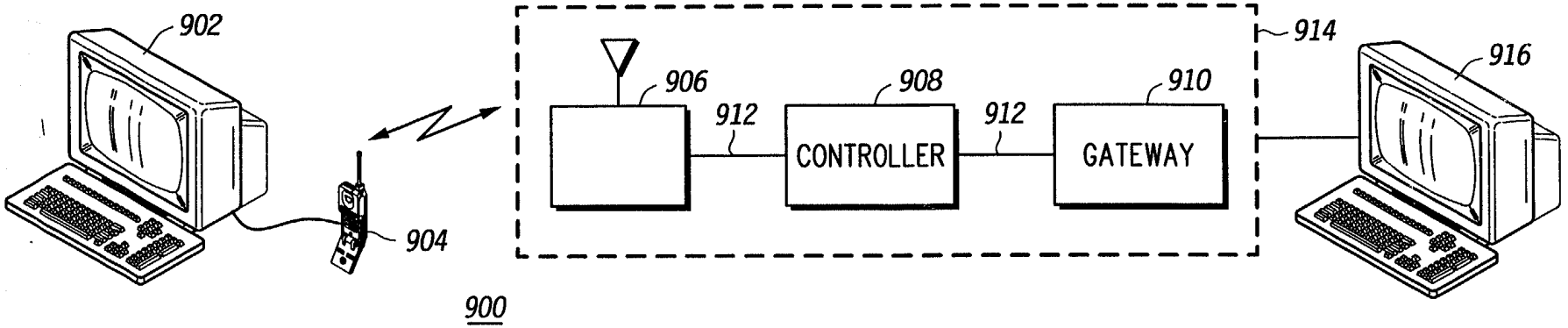

902
906
912
CONTROLLER
912
GATEWAY
914
916
904
900

FIG.9

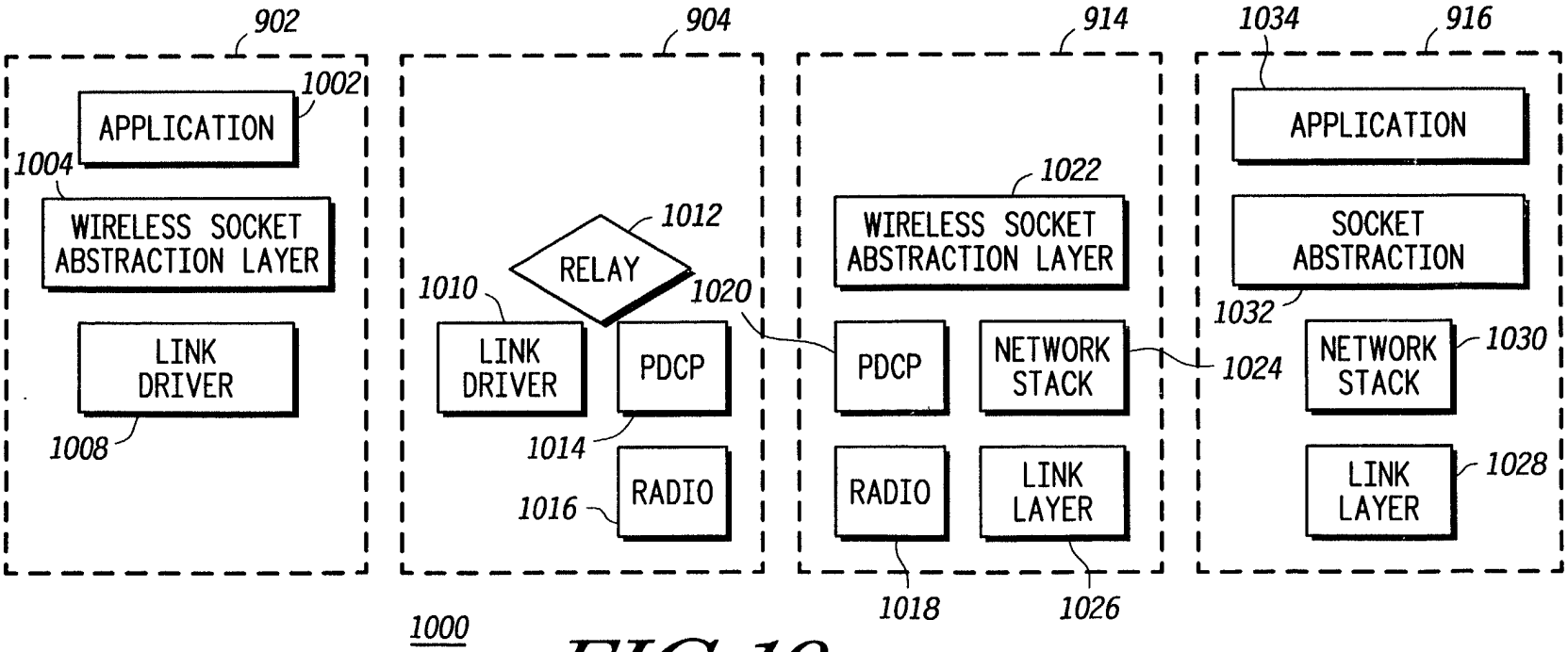

902
904
914
1034
916
1002
APPLICATION
1004
WIRELESS SOCKET ABSTRACTION LAYER
LINK DRIVER
1008
1012
RELAY
1010
LINK DRIVER
1020
PDCP
1014
RADIO
1016
1022
WIRELESS SOCKET ABSTRACTION LAYER
PDCP
NETWORK STACK
1024
RADIO
LINK LAYER
1018
1026
APPLICATION
SOCKET ABSTRACTION
1032
NETWORK STACK
1030
LINK LAYER
1028
1000

FIG.10

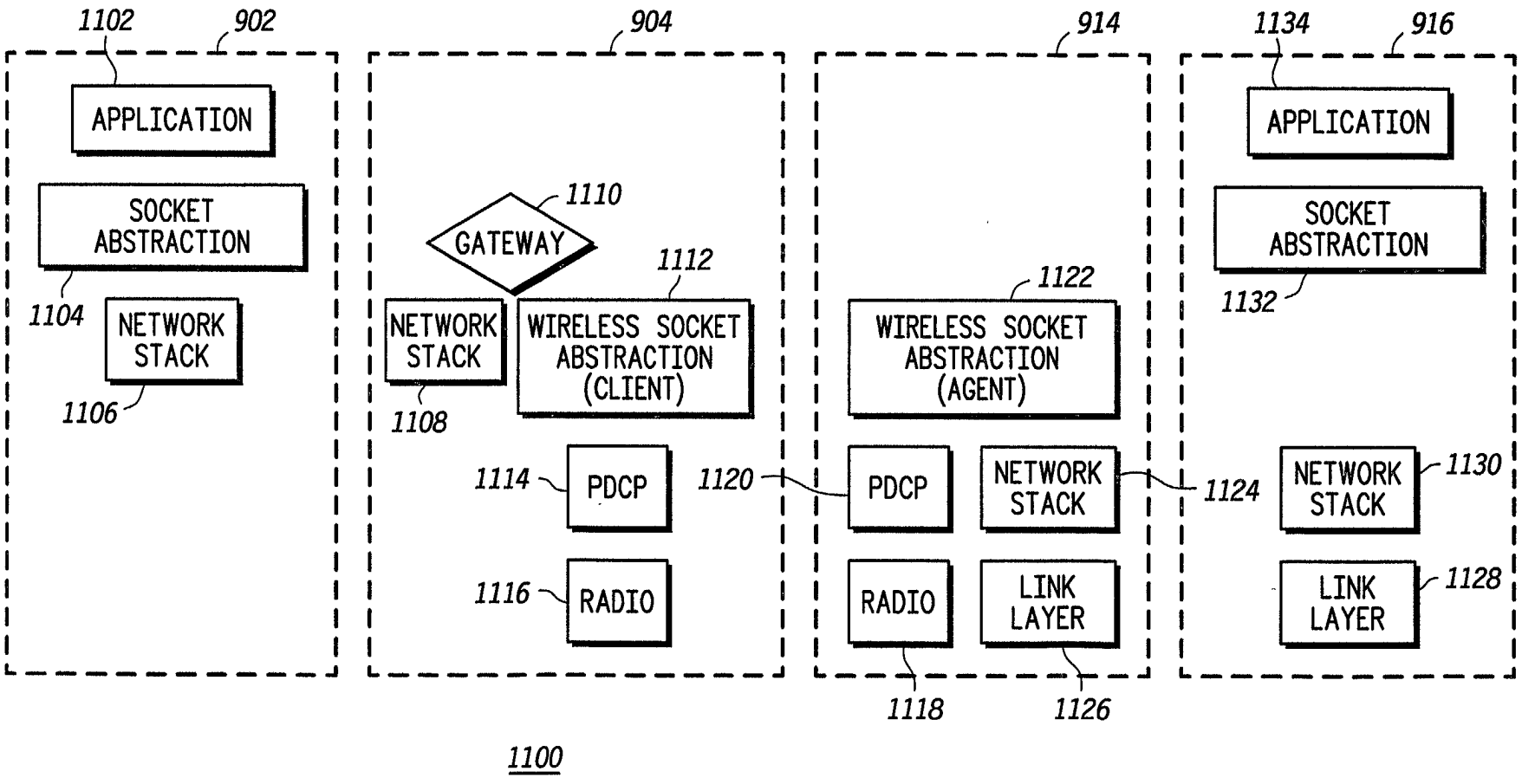

1102
902
APPLICATION
SOCKET ABSTRACTION
1104
NETWORK STACK
1106
904
1110
GATEWAY
1112
NETWORK STACK
1108
WIRELESS SOCKET ABSTRACTION (CLIENT)
1114
PDCP
1116
RADIO
914
1122
WIRELESS SOCKET ABSTRACTION (AGENT)
1120
PDCP
NETWORK STACK
1124
RADIO
LINK LAYER
1118
1126
1134
916
APPLICATION
SOCKET ABSTRACTION
1132
NETWORK STACK
1130
LINK LAYER
1128
1100

FIG.11

FIG.12A

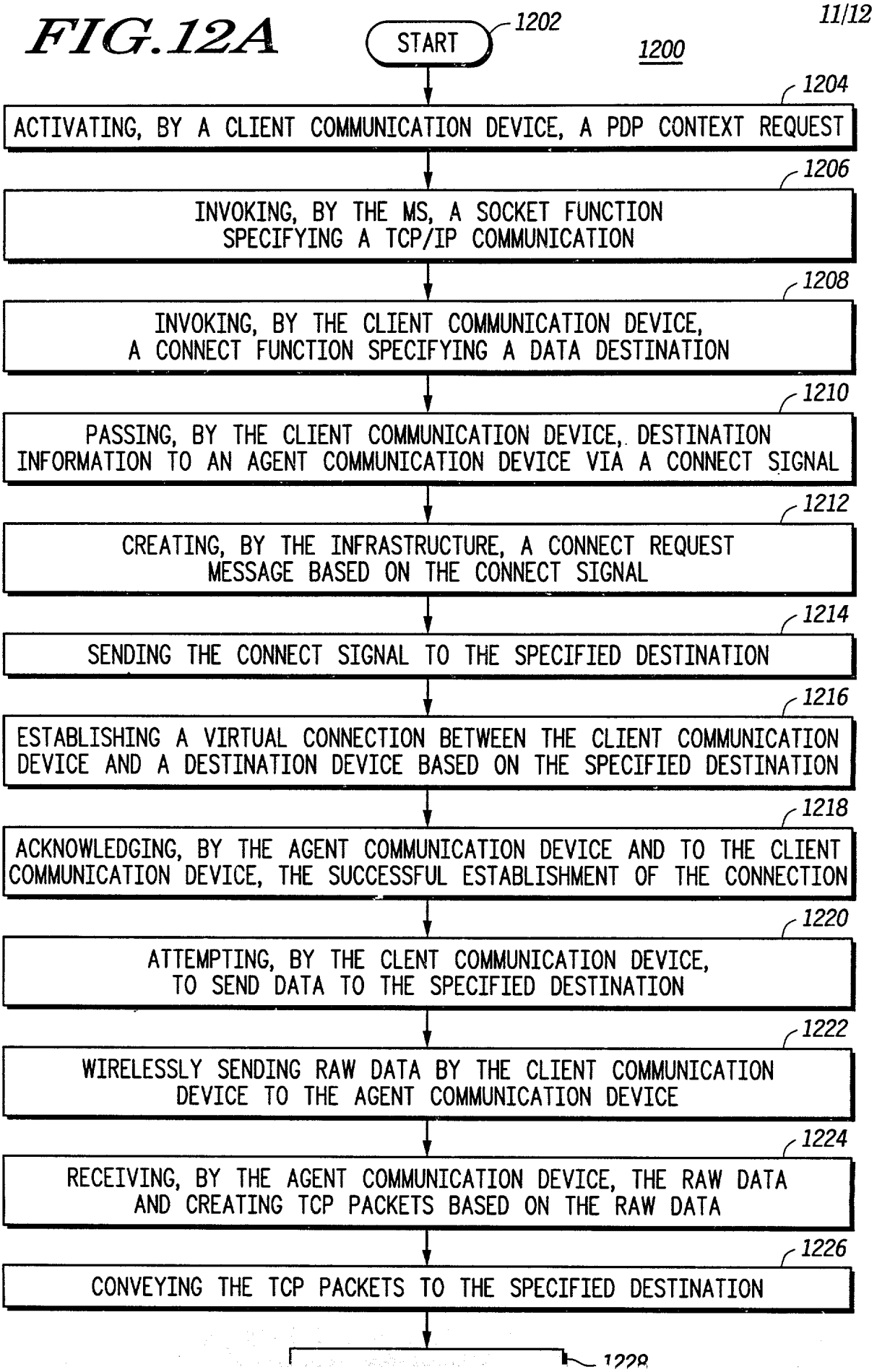
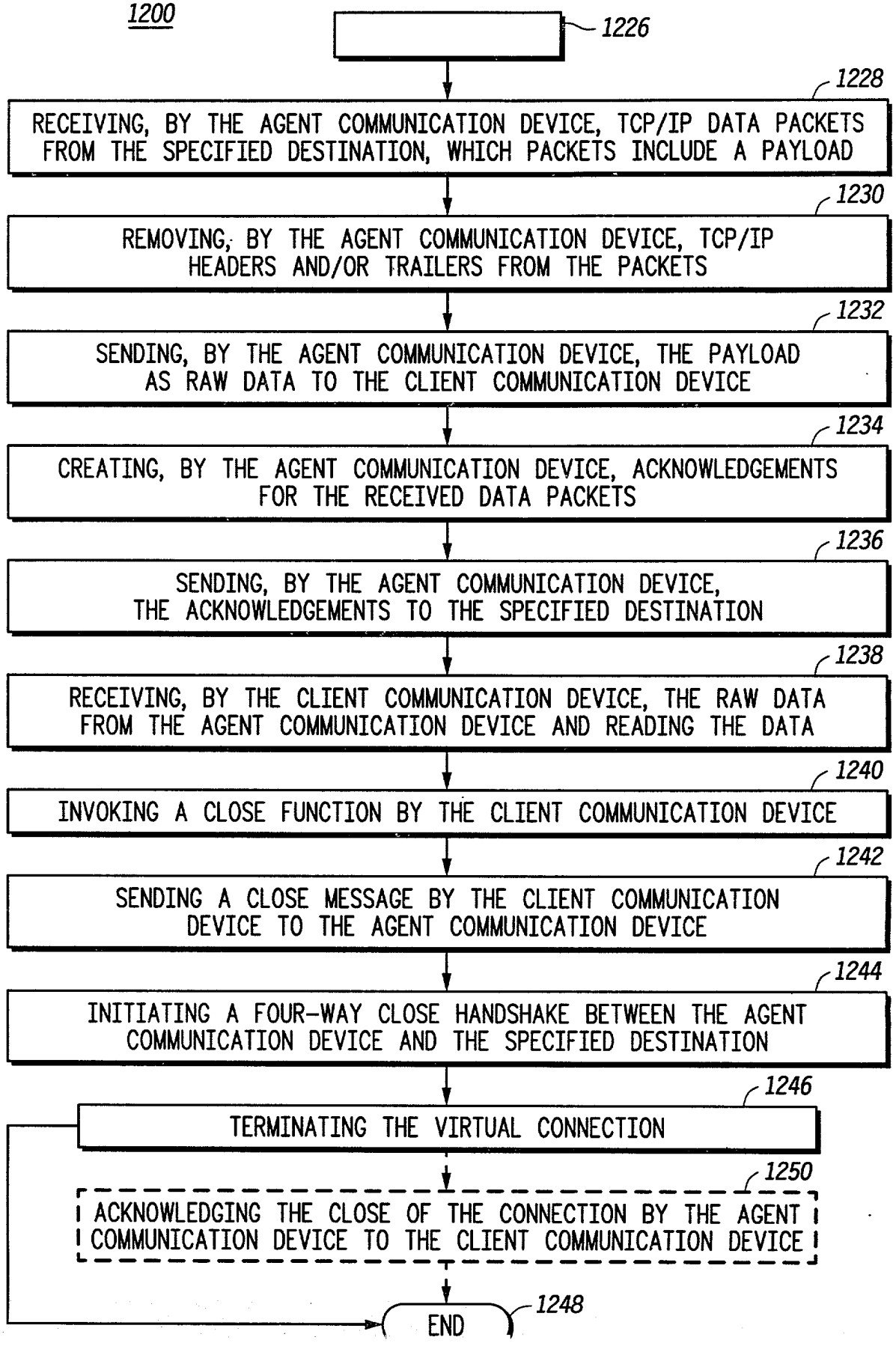

START
1202
1200
1204
ACTIVATING, BY A CLIENT COMMUNICATION DEVICE, A PDP CONTEXT REQUEST
1206
INVOKING, BY THE MS, A SOCKET FUNCTION SPECIFYING A TCP/IP COMMUNICATION
1208
INVOKING, BY THE CLIENT COMMUNICATION DEVICE, A CONNECT FUNCTION SPECIFYING A DATA DESTINATION
1210
PASSING, BY THE CLIENT COMMUNICATION DEVICE, DESTINATION INFORMATION TO AN AGENT COMMUNICATION DEVICE VIA A CONNECT SIGNAL
1212
CREATING, BY THE INFRASTRUCTURE, A CONNECT REQUEST MESSAGE BASED ON THE CONNECT SIGNAL
1214
SENDING THE CONNECT SIGNAL TO THE SPECIFIED DESTINATION
1216
ESTABLISHING A VIRTUAL CONNECTION BETWEEN THE CLIENT COMMUNICATION DEVICE AND A DESTINATION DEVICE BASED ON THE SPECIFIED DESTINATION
1218
ACKNOWLEDGING, BY THE AGENT COMMUNICATION DEVICE AND TO THE CLIENT COMMUNICATION DEVICE, THE SUCCESSFUL ESTABLISHMENT OF THE CONNECTION
1220
ATTEMPTING, BY THE CLENT COMMUNICATION DEVICE, TO SEND DATA TO THE SPECIFIED DESTINATION
1222
WIRELESSLY SENDING RAW DATA BY THE CLIENT COMMUNICATION DEVICE TO THE AGENT COMMUNICATION DEVICE
1224
RECEIVING, BY THE AGENT COMMUNICATION DEVICE, THE RAW DATA AND CREATING TCP PACKETS BASED ON THE RAW DATA
1226
CONVEYING THE TCP PACKETS TO THE SPECIFIED DESTINATION
1228

FIG.12B


1200
1226
1228
RECEIVING, BY THE AGENT COMMUNICATION DEVICE, TCP/IP DATA PACKETS FROM THE SPECIFIED DESTINATION, WHICH PACKETS INCLUDE A PAYLOAD
1230
REMOVING, BY THE AGENT COMMUNICATION DEVICE, TCP/IP HEADERS AND/OR TRAILERS FROM THE PACKETS
1232
SENDING, BY THE AGENT COMMUNICATION DEVICE, THE PAYLOAD AS RAW DATA TO THE CLIENT COMMUNICATION DEVICE
1234
CREATING, BY THE AGENT COMMUNICATION DEVICE, ACKNOWLEDGEMENTS FOR THE RECEIVED DATA PACKETS
1236
SENDING, BY THE AGENT COMMUNICATION DEVICE, THE ACKNOWLEDGEMENTS TO THE SPECIFIED DESTINATION
1238
RECEIVING, BY THE CLIENT COMMUNICATION DEVICE, THE RAW DATA FROM THE AGENT COMMUNICATION DEVICE AND READING THE DATA
1240
INVOKING A CLOSE FUNCTION BY THE CLIENT COMMUNICATION DEVICE
1242
SENDING A CLOSE MESSAGE BY THE CLIENT COMMUNICATION DEVICE TO THE AGENT COMMUNICATION DEVICE
1244
INITIATING A FOUR-WAY CLOSE HANDSHAKE BETWEEN THE AGENT COMMUNICATION DEVICE AND THE SPECIFIED DESTINATION
1246
TERMINATING THE VIRTUAL CONNECTION
1250
ACKNOWLEDGING THE CLOSE OF THE CONNECTION BY THE AGENT COMMUNICATION DEVICE TO THE CLIENT COMMUNICATION DEVICE
1248
END